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GROUND-BASED MIDCOURSE DEFENSE: CONTINUE TESTING, BUT OPERATIONAL FIELDING MUST TAKE A BACKSEAT TO THEATER MISSILE DEFENSE AND HOMELAND SECURITY

by

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A paper submitted to the Faculty of the Joint Advanced Warfighting School in partial satisfaction of the requirements of a Master of Science Degree in Joint Campaign Planning and Strategy.

The contents of this paper reflect my own personal views and are not necessarily endorsed by the Joint Forces Staff College or the Department of Defense.

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ABSTRACT

The Ground-Based Midcourse Defense (GMD) system has been rushed into operation in Alaska but does not yet provide any defense against the thousands of nuclear warheads of Russia's 700 inter-continental ballistic missiles (ICBMs). GMD will not protect America from the twenty or so nuclear missiles owned by China. There are only two other countries (Britain and France) that have ICBMs capable of reaching the United States. Thus, GMD is being deployed almost exclusively against the possibility that North Korea and Iran will develop ICBMs. Although an effective GMD is a necessity, it is not yet technologically mature enough. Deploying a GMD system now is a mistake – effective, deployable theater missile defenses and improving port and border security to prevent the non-traditional delivery of WMD into the United States are more relevant and much more necessary than deploying a missile defense that is not yet technically mature.

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Introduction

The United States has spent approximately $100 billion for a National Missile Defense (NMD) with over $50 billion spent in the last five years (DOD, 2005). The Ground-Based Midcourse Defense (GMD) system has been rushed into operation in Alaska but does not yet provide any defense against the thousands of nuclear warheads of Russia's 700 inter-continental ballistic missiles (ICBMs). GMD will not protect America from the twenty or so nuclear missiles owned by China. There are only two other countries (U.S. allies Britain and France) that have ICBMs capable of reaching the United States. Thus, GMD is being deployed almost exclusively against the possibility that North Korea and Iran will develop ICBMs. As will be examined later in this thesis, even if North Korea and Iran field a working ICBM, they are a long way from developing a nuclear weapon safe enough to attach to it.

In fact, intelligence estimates are uncertain how close North Korea and Iran are to deploying, let alone testing, an ICBM that can hit the United States. The last ballistic missile threat National Intelligence Estimate (NIE), stated that "our assessments of future missile developments are inexact and subjective because they are based on often fragmentary information (NIC, 2001)." Iran's latest ballistic missile achievement announced in September 2004 was that it had produced an upgraded version of its Shahab-3 medium range ballistic missile (MRBM) that has a range of 1,250 miles – a fraction of the range required to reach the United States (Cabbage, 2004). Guidance systems needed to accurately steer long-range missiles to their targets require a level of sophistication far beyond anything North Korea or Iran has yet demonstrated. Development of re-entry vehicles that shroud the warheads as they re-enter the Earth's atmosphere is almost as challenging. And large, crude nuclear devices must be made smaller and lighter to travel long distances on an ICBM (Cabbage, 2004). Robert Walpole, a

CIA analyst responsible for the National Intelligence Estimate, testified to the Senate in February 2000:

> "In fact, we project that in the coming years, U.S. territory is probably more likely to be attacked with weapons of mass destruction from non-missile delivery means (most likely from non-state entities) than by missiles, primarily because non-missile delivery means are less costly and more reliable and accurate. They can also be used without attribution. (Eisendrath et al, 2001)"

The National Intelligence Committee report on ballistic missile threats through 2015 confirms that the only projected ballistic missile threat, in addition to Russia and China, will possibly come from North Korea and Iran (NIC, 2001). The U.S. missile defense against Russia and China will remain what it has been for more than 40 years: deterrence, or the threat of a devastating nuclear counterattack (Cabbage, 2004). Should not the same strategy also work against North Korea and Iran? Or more importantly, are we rushing GMD into operation when instead we should continue testing and invest more in border and port security to protect against the non-traditional delivery methods of WMD?

The 2002 National Security Strategy, National Security Presidential Directive 23, and the President's National Policy on Ballistic Missile Defense Fact Sheet all state that deploying a National Missile Defense system is of the highest priority. Deploying a national missile defense is of such a high priority that the system is being budgeted for approximately $10 billion a year (GAO, 2005). But is a GMD system the most cost effective way to defend America from a missile threat? The 2005 National Defense Strategy states that "Our missile defense program aims to dissuade adversaries by imposing operational and economic costs on those who would employ missiles to threaten the United States, its forces, its interests, or its partners (GPO, 2005)." We must first defend against the likely threats such as smuggled WMD and cruise missiles equipped with WMD that could be easily fired from off shore (and would fly under the

GMD radars). These more likely threats are cheaper, thus no economic costs have truly been imposed on our adversaries.

It is the aim of this thesis to prove that deploying a GMD system now is a mistake – effective, deployable theater missile defenses and improving port and border security to prevent the non-traditional delivery of WMD into the United States are more relevant and much more necessary than deploying a national missile defense that is not yet technically mature. For GMD, technological hurdles are still too high and there are severe global strategic repercussions in deploying GMD that work counter to the goals in the National Security Strategy – much diplomatic groundwork still needs to be laid. For potential enemies, there are cheaper, easier, more reliable, and much more discrete methods of delivering weapons of mass destruction.

With the increasingly expeditionary nature of the U.S. armed forces, theater missile defenses must be the priority for research, development, and funding. Additionally, based on the latest NIE's and the terrorist attacks that occurred on September 11th, a nuclear weapon will likely be delivered via boat or truck, not by missile. If the nuclear threat to America is of such high priority, then money would be better spent on beefing up port and border security. Make no mistake, eventually fielding a working GMD is necessary, but wasting money on pushing it into operation before it is truly ready is a mistake America cannot afford.

Ballistic Missile Basics

In this chapter, the basic definitions of the various types of ballistic missiles and how their flight paths are defined will be discussed. A basic understanding of the different types of missiles and their flight paths will ensure that concepts and terms discussed later in the thesis will be better understood.

A ballistic missile is a missile that usually has no wings or fins with a prescribed flight path that cannot be altered after the missile has burned its fuel. The missile's flight and course is governed by the laws of ballistic physics. In order to cover long distances, ballistic missiles must be launched very high into the air or in space, typically incurring sub-orbital spaceflight. For ICBMs, the halfway altitude is approximately 1,200 kilometers (MDA, 2005). Long and medium range ballistic missiles are generally designed to deliver nuclear warheads because their payload is too limited for conventionally armed missiles to be efficient and because the extreme heat of re-entry could damage chemical or biological payloads. Ballistic missiles vary widely in range and use, but the United States distinguishes the following categories (MDA, 2004):

- Intercontinental ballistic missile (ICBM): range greater than 5500 kilometers
- Intermediate-range ballistic missile (IRBM): range between 3000 and 5500 kilometers
- Medium-range ballistic missile (MRBM): range between 1000 and 3000 kilometers
- Short-range ballistic missile (SRBM): range less than 1000 kilometers

Note: Medium and short range missiles are commonly called theater ballistic missiles (TBM).

There are three distinct phases of ballistic missile flight: boost, midcourse, and terminal (MDA, 2004). In the boost phase, the ballistic missile's engine (powered by liquid or a more

complex solid propellant) ignites and propels the missile into, and in many cases, out of the atmosphere. This is the earliest point in the missile's flight path for an intercept (MDA, 2004). During the boost phase, the ballistic missile is easier to detect and track due to its bright, hot exhaust (MDA, 2004). This is significant as many sensors work in the infrared range where a bright and hot exhaust makes the missile easy to detect. The boost phase is extremely short and requires quick reaction and a nearby means of destroying the missile (MDA, 2004).

Following the boost phase is the midcourse phase during which the missile's booster burns out and the missile begins a ballistic trajectory based on its forward momentum and pull of gravity. The midcourse phase is typically the longest phase of flight (approximately 20 minutes for an ICBM) and generally occurs outside the atmosphere in the case of an ICBM (MDA, 2004). This phase offers the defender several possible opportunities to shoot down the missile. It is also the phase that the missile may deploy a reentry vehicle which is the part of the missile that carries the weapon payload as well as possible countermeasures that try to give the reentry vehicle more of a chance to slip through defenses. Thus, a midcourse intercept can be difficult as the reentry vehicle will likely be surrounded by booster debris and possibly countermeasures (MDA, 2004). An intercept in the midcourse phase may require different sensors including those onboard the interceptor that are able to find the reentry vehicle among the booster debris and possible decoys. The intercept can further be complicated if there are multiple and independently targeted reentry vehicles on the missile.

The terminal phase of a ballistic missile's flight is the last opportunity for intercept prior to detonation or impact. As the reentry vehicle speeds toward the target, the reentry vehicle should be separated from the booster debris field due to atmospheric drag. Terminal intercepts require advanced interceptors due to the possibility that the reentry vehicle may be programmed

to conduct final maneuvers to complicate a fire control solution (MDA, 2004). Intercept scenarios in any of the three phases – boost, midcourse, and terminal – require accurate missile tracking (of both the target and the interceptor), extremely quick reaction time, advanced interceptors or directed energy, reliable communications, and advanced sensors (MDA, 2004).

Missile Defense History: A Troubled Past

This chapter discusses the colored past of American efforts at fielding a missile defense system. The chapter will explore the checkered past and political issues surrounding several versions of past missile defense efforts and also provide some insight into the technical challenges that have always plagued development efforts.

Attack by ballistic missiles has been a concern since Germany launched V-2 rockets at England during World War II. Ballistic missiles are unpowered and unassisted by aerodynamic lift control for most of their trajectory unlike powered cruise missiles such as Tomahawk or glide missiles such as the Joint Defense Attack Munition (JDAM). A true ballistic missile is only under power while the booster burns at the initial phase of flight, although some advanced missiles have the capability to maneuver in the terminal phase. Most research in U.S. missile defenses has focused on the midcourse and terminal phases, although there has been recent interest in a boost phase intercept capability.

When the Soviet Union deployed its first ICBMs in 1960, the U.S. armed forces were pursuing several ballistic missile defense (BMD) programs. In the 1950's, Project Defender was comprised of nuclear tipped interceptors of the Nike-Zeus, Nike-X, and then the Sentinel, none of which were ever proven successful (GPO, 1962). Even though the systems of the time were unproven, the Kennedy Administration assigned Project Defender to the highest category of national priorities for funding, research, and development (GPO, 1962).

In 1969, President Nixon authorized the Safeguard system to protect Minuteman missiles at Grand Forks, North Dakota. The system was only briefly operational in 1976 to defend the Grand Forks ICBM field but was dismantled shortly thereafter due to its uselessness after spending $6 billion. In 1972 the Anti-Ballistic Missile (ABM) treaty between President Richard

Nixon and Soviet leader Leonid Brezhnev was signed. In short, the treaty agreed to limit both offensive and defensive missile systems, forbade both sides from developing a national missile defense system, and did not allow ABM associated testing. After the ABM treaty was ratified, the United States expended little effort on developing ballistic missile defenses until the early 1980's. Not until the fear of a Soviet first-strike capability against U.S. strategic forces and the majority of American metropolitan areas dominated the media and the general population did work on missile defense continue (Eisendrath et al, 2001).

On March 25, 1983 President Reagan signed the National Security Decision Directive 85 which institutionalized the Strategic Defense Initiative (SDI) which would eventually cost $60 billion (Eisendrath et al, 2001). At the time, technological progress in guidance systems, sensors, boosters, and command and control systems provided false hope that a "hit-to-kill" capability was within reach (Eisendrath et al, 2001). Enthusiasm for hit-to-kill capability was given a boost when a kill vehicle launched from Kwajalein Atoll intercepted a dummy ICBM warhead launched from Vandenberg Air Force Base in a highly scripted Army test (Eisendrath et al, 2001).

In 1987, it became publicized that the SDI systems under development would not knock out even a small percentage of a Soviet first strike. The Soviets were advised by their scientists that SDI's capability to destroy incoming missiles could not be achieved (Eisendrath et al, 2001). Even though SDI never became operational, it has often been hailed as causing the collapse of the Soviet Union. Although a contributing factor, the U.S. employed many other methods to counter the Soviet Union, many of them via economic means. The myth that SDI single-handedly forced increased Soviet military expenditures resulting in the Soviet Union's collapse is contradicted in the following exchange between President Reagan and Mikhail Gorbachev:

> The President said, "We are going forward with the research and development necessary to see if this [SDI] is a workable concept and if it is, we are going to deploy it."
> Gorbachev answered. "Mr. President, you do what you think you have to do….And if in the end you think you have a system you want to deploy, go ahead and deploy it. Who am I to tell you what to do? I think you're wasting money. I don't think it will work. But if that's what you want to do, go ahead. (Talbott, 1988)

SDI was originally focused on defending against a large-scale Soviet attack, so at the time concepts for BMD systems included large numbers of interceptors. In 1991, engineers at Lawrence Livermore National Laboratory proposed a constellation of small, smart, space-based interceptors – called Brilliant Pebbles – that were intended to destroy target ICBMs during their boost phase. By attacking an ICBM in that phase, before its multiple independently targeted reentry vehicles (MIRV) could be deployed, a single Brilliant Pebbles interceptor could potentially destroy as many as ten Soviet warheads. Although early concepts to defend against worst-case scenarios envisioned deploying as many as 100,000 Brilliant Pebbles, later estimates were reduced to around 7,000 (Baucom, 2001)

The end of the Cold War caused fundamental changes in how a strategic missile defense should be designed and employed. The focus shifted from countering a large-scale Soviet attack to two other objectives: defending the United States against accidental or limited ICBM strikes and defending deployed U.S. forces against attacks by theater (shorter range) ballistic missiles such as Scuds. Some defense planners argued that limited strikes against the United States could be a threat if rogue elements in the former Soviet Union seized control of strategic nuclear weapons or if ICBM technology proliferated to other countries.

The threat posed to deployed forces by theater ballistic missiles was demonstrated during Operation Desert Storm when an Iraqi Scud missile killed 28 soldiers in Al Khobar, Saudi

Arabia (Eisendrath et al, 2001). However, in 1992 the U.S. Army acknowledged that the Patriot system only shot down 52 percent of the Scuds shot at during Desert Storm (Eisendrath et al, 2001). The General Accounting Office (GAO), using the Army's own methodology and evidence concluded that Patriots hit only nine percent of the Scuds engaged (Eisendrath et al, 2001). Since then, improvements via the PAC-2 GemPlus and PAC-3 upgrades have been made that have improved the performance of the Patriot missile.

In 1991, the Missile Defense Act was enacted which defined the goal to deploy a system to defend against limited attacks by ballistic missiles while still complying with the ABM Treaty. With the ABM Treaty's limitation on developing defenses against ICBMs, and in the wake of the Scud attacks during Desert Storm, BMD efforts focused on developing theater-level defenses against missiles in their terminal phase. Those efforts resulted in systems such as Patriot Advanced Capability-3 (PAC-3) and the Theater High-Altitude Air Defense (THAAD). THAAD and PAC-3 were permitted under a 1997 agreement among the parties to the ABM treaty because they lacked the capability to defeat long-range ballistic missiles.

During the mid-1990s, intelligence estimates of threats to the United States incited greater interest in developing a national missile defense (CBO, 2004). The Department of Defense announced a program in 1996 that called for three years of development of an NMD system. If the system's components tested successfully and there was still a threat, then within three years a working system should be deployed (CBO, 2004). The system would include: a new tracking radar, twenty missile interceptors based in Alaska, upgrades to existing missile defense radars, space-based sensors, and a command and control system. All of this would involve withdrawing from the 1972 ABM Treaty. In September, 2000, President Clinton deferred a deployment decision until 2006 or 2007 (Eisendrath et al, 2001). His decision was

based on Department of Defense Director of Operational Test and Evaluation Philip E. Coyle, who warned that “deployment means the fielding of an operational system with some military utility which is effective under realistic combat conditions, against realistic threats and countermeasures when operated by military personnel at all times of day or night and in all weather. Such a capability is yet to be shown to be practicable for NMD (Eisendrath et al, 2001).”

In February 2001, Secretary of Defense, Donald Rumsfeld, traveled to NATO headquarters in Brussels, Belgium to inform NATO leaders that the Bush administration was determined to deploy a National Missile Defense (Eisendrath et al, 2001). European representatives replied that the United States was moving too fast and that deploying a National Missile Defense would set off a new arms race (Eisendrath et al, 2001). Signals from other countries around the world were also unanimous in this opinion and there was concern over what the implications would be for the 1972 ABM Treaty (Eisendrath et al, 2001).

In the end, the Bush Administration withdrew the United States from the ABM treaty. BMD efforts were broadened to develop and deploy systems to defend against ballistic missiles of all ranges in all phases of flight (CBO, 2004). To meet that goal, the Missile Defense Agency (MDA) is working on a variety of sensors, weapons, and command and control systems that will be integrated into a layered ballistic missile defense system (CBO, 2004).

Components of the Ground-Based Midcourse Defense System

This chapter provides a description of the various components and the mission of the Ground-Based Midcourse Defense (GMD) system. Providing descriptions of GMD components and introducing the various TMD systems into development will enable a better understanding of the threats to the United States that are discussed in the next chapter.

Ballistic missile defense can be divided into two main categories: National (strategic) Missile Defense and Theater Missile Defense although the terms "upper tier" (strategic) and "lower tier" (theater) are also used. GMD is considered a strategic, or upper tier system. Theater missile defense systems operate within the atmosphere, defend a small area, and generally intercept missiles with a range of less than 1000 kilometers (MDA, 2004). Strategic missile defense systems operate outside the atmosphere, defend a larger area, use an interceptor designed to operate outside the atmosphere and defend against missiles with ranges of 4000-5000 kilometers (MDA, 2004). Recently, it has been proposed that theater missile defense be included in national missile defense. When referring to NMD, most people are in fact talking about the Ground-based Midcourse Defense (GMD) system. The GMD project officially began in 1998 with a $1.6 billion contract to Boeing with Raytheon, TRW, Lockheed Martin as major subcontractors (MDA, 2004).

Once completed, GMD will consist of an array of synchronized and complex components: Air Force Defense Support Program (DSP) satellites; Space Based Infrared System-High (SBIRS-High) satellites; the Space Tracking and Surveillance System (STSS) (formerly known as SBIRS-low); Upgraded Early Warning Radars (UEWRs); a Battle Management, Command Control and Communications (BMC3) unit; the Sea Based X-Band Radar (SBX); and Ground-Based Interceptor (GBI) missiles.

In a typical ICBM defense scenario, DSP and SBIRS-High satellites would scan for hostile ballistic missile launches. Once a threat has been detected, the satellites estimate the missile's flight path. STSS monitors the incoming missile as it approaches, while the UEWRs predict its final destination. This process allows GMD to launch its interceptors as early as possible. The BMC3 unit on the ground integrates all surveillance and tracking information. Once launched, the GBI speeds toward the target's predicted location receiving updates along the way. Although not yet deployed, the SBX will differentiate between warheads and decoys. At a predetermined point, the GBI will release an Exoatmospheric Kill Vehicle (EKV) which has its own infrared seeker and motor and is designed to "hit to kill" (MDA, 2004).

There are several TMD systems that are either operational, close to operational, or in development. The Aegis Ballistic Missile Defense system integrates the Aegis Combat System installed on U.S. Navy ships deployed around the world with the Standard Missile-3 (SM-3) to provide protection against short to intermediate range ballistic missiles (MDA, 2004). The Airborne Laser operates aboard a modified Boeing 747-400 and is designed to detect, track, and kill ballistic missiles in their boost phase using a high energy laser. The Patriot Advanced Capability-3 (PAC-3) system currently operational with the U.S. Army, is a land-based system capable of destroying short to medium range threats using hit-to-kill technology. The Medium Extended Air Defense System (MEADS) is an international development effort based on the Patriot PAC-3. The Terminal High Altitude Area Defense System (THAADS) is a rapidly transportable system that will intercept and destroy ballistic missiles in and above the atmosphere while they are in the terminal phase of flight.

The "Threats"

The raison d'etre for GMD is to defend the United States against limited ballistic missile attacks. The scenarios commonly discussed are limited attacks from China, Russia, Iran, and North Korea. In fact, the 1999 and 2001 National Intelligence Estimates (NIE) and the 1998 report of the Commission to Assess the Ballistic Missile Threat to the United States (also known as the Rumsfeld report) assessed that ballistic missile threats from Iran and North Korea (Iraq is obviously not a concern anymore) are the two primary threats. However, the 1995 NIE concluded that there is no country (or non-state actors) outside of the five major nuclear powers "that will develop or otherwise acquire a ballistic missile in the next 15 years that could threaten the contiguous 48 states and Canada (NIE, 1995)." The 1995 NIE also affirmed that the United States could easily detect any Third World ICBM program. The prediction was that the United States would have a minimum of five years' warning from when a country started testing and the time it would actually deploy a working ICBM. What changed between 1995 and 1999? Most likely it was the 1998 Rumsfeld report that changed some of the conclusions drawn in the 1999 NIE.

Most concern was generated regarding the threat from North Korea and Iran after the release of the Rumsfeld report and has continued ever since. The methodology used in the Rumsfeld report differed from previous analyses by estimating the time it would take a country to build a long-range missile based on an assessment of its technical capabilities, not on observed or demonstrated missile capabilities, missile development programs, or observed test launches (Wright, 2000). Another flaw in the Rumsfeld report is that the commission went outside the intelligence community to contractors for information. In fact, the Rumsfeld report commission relied heavily on a briefing by Lockheed Martin that resulted in the assertion that a

technologically capable country could field a working ICBM in five years (Graham, 2003). The commission may have relied too heavily on a contractor who had a vested interest in securing a large government contract.

Before examining each threat individually, one must first examine how the world as a whole has changed since the Cold War when referring to ballistic missiles. Of the global arsenal of ballistic missiles, Russia and the United States have 95 percent (Cirincione, 2005). Only Russia and China have missiles with ranges long enough that can reach Europe or the United States. Why then all the concern about the "numerous" threats? Joseph Cirincione of the Carnegie Endowment for International Peace (CEIP) sums it up nicely: "The oft quoted assessment is that there are over 25 nations that possess ballistic missiles but only the United States, China, Russia, France, and the United Kingdom have the ability to launch nuclear warheads on ICBMs (Cirincione, 2005)." From Mr. Cirincione's CEIP 2005 Ballistic Missile Policy Outlook paper:

- Analysis of global ballistic missile arsenals shows that there are far fewer ICBMs and long-range submarine-launched ballistic missiles (SLBMs) in the world today than there were during the Cold War.
- The number of intermediate-range ballistic missiles (IRBMs), i.e. missiles with a range of 3,000–5,000 km, has decreased in the past 15 years by an order of magnitude.
- The overall number of medium-range ballistic missiles (MRBMs), i.e. missiles with a range of 1,000-3,000 km, has also decreased. Five new countries, however, have developed or acquired MRBMs since the late 1980's.

• The number of countries trying to develop ballistic missiles has also decreased and the nations still attempting to do so are poorer and less technologically advanced than were the nations 15 years ago.

• The number of countries with short-range ballistic missiles (SRBMs), i.e. missiles with ranges up to 1,000 km, has remained fairly static over the past 20 years and is now beginning to decrease as aging inventories are retired.

• Today, fewer nations potentially hostile to the United States and Europe are trying to develop MRBMs compared with 15 years ago (1980s: China, Iraq, Libya and the Soviet Union; 2004: China, Iran and North Korea).

• The damage from a ballistic missile attack on U.S. territory, U.S. forces and European allies today with one or two warheads is lower by orders of magnitude than fifteen years ago when thousands of warheads would have destroyed the country and possibly all human life on the planet. (Cirincione, 2005)

The following chart graphically illustrates how much ballistic missile arsenals have diminished since 1987 (the height of the Cold War and in the heyday of the Reagan Administration's SDI program).

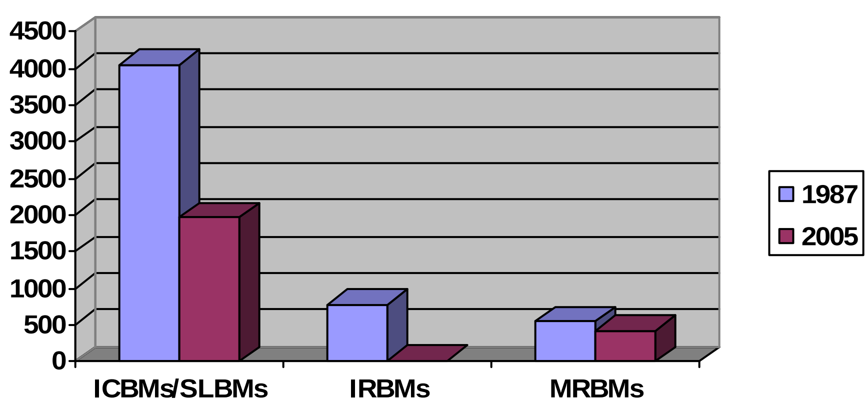

Table 1. Long and Medium-Range Ballistic Missiles, 1987-2005. (Cirincione, 2005).

In summary, only five countries have ICBMs and only six countries have medium-range ballistic missiles (1,000-3,000 kilometers): Israel, Saudi Arabia, India, Pakistan, North Korea and Iran. These missiles cannot reach the United States. A majority of countries have Scuds which only have a range of 300 kilometers. If the majority of countries that possess ballistic missiles only have missiles with relatively short ranges in their inventories, then fielding effective theater missile defenses should be much more important than GMD. GMD testing should continue as an investment against the future capabilities of Iran and North Korea, but the two countries are likely too far from fielding ICBMs to warrant rushing GMD into operation. Although Russia and China possess ICBMs capable of hitting the United States, their inventories are large enough to easily defeat any system the U.S. can field for the foreseeable future; deterrence should continues to suffice for now. A country-by-country discussion of ballistic missile threats follows.

China

China received IRBMs from Russia in the late 1950s, and by the mid-1960s had reversed engineered them and produced their first missile, the CSS-1 (Bennett, 1999). As of this writing, China has approximately twenty ICBMs that can reach the United States, but it is predicted that by 2015 the total number of Chinese strategic missiles will increase several-fold though they will still have far less than Russian or U.S. forces (NIC, 2001). There is also speculation that due to the relatively closed society of China, the numbers may be much higher. China maintains its ICBMs in a low alert status, has no appreciable early warning system and thus has no real ability to “launch on warning” (Wright, 2000). Additionally, China maintains its ICBMs without fuel

or warheads which make it impossible to fire its missiles accidentally under normal alert conditions (Lindsay, 2001). China also maintains a robust MRBM force and continues to increase the capabilities of its SRBM force deployed opposite Taiwan. China has also added a new, more capable ballistic missile submarine to its arsenal which will be able to carry Sea-Launched Ballistic Missiles (SLBM) with enough range to strike globally (Gertz, 2004). Table 2 summarizes China's current inventory which is growing in capability and numbers.

Designation	Alternate Name	Class	Payload	Range (km)	Status
CSS-2	DF-3	MRBM	Single warhead, 2,150 kg	2,650	Operational
CSS-2A	DF-3A	IRBM	Single warhead, 2,150 kg or 2,500 kg	2,800	Operational
CSS-3	DF-4	IRBM	Single warhead, 2,200 kg	4,750	Operational
CSS-4	DF-5	ICBM	Single warhead, 3,000 kg	12,000	Operational
CSS-4A	DF-5A	ICBM	Single warhead or 4 to 6 MIRV, 3,200 kg	13,000	Operational
CSS-5	DF-21	MRBM	Single warhead, 600 kg	2,150	Operational
CSS-5 Mod 2	DF-21A	MRBM	Single warhead, 500 kg	2,500	Operational
CSS-6	DF-15/M-9	SRBM	Single warhead, 500 kg	600	Operational
CSS-7	DF-11/M-11	SRBM	Single warhead, 800 kg	280-350	Operational
CSS-7 Mod 2	DF-11A	SRBM	Single warhead, 500kg	350-530	Operational
CSS-8	M-7, Project 8610	SRBM	Single warhead, 190 kg	50-150	Operational
CSS-9 (DF-31)	DF-31	ICBM	Single warhead or 3 to 5 MIRV, 1,050 to 1,750 kg	8,000	Operational
CSS-N-3	JL-1	SLBM	Single warhead, 600 kg	2,150	Operational
CSS-N-3 Mod 1	JL-1A, JL-21A	SLBM	Single warhead, 500 kg	2,500	Operational
CSS-NX-5 (JL-2)	JL-2	SLBM	Single warhead or 3-8 MIRV, 1,050 to 2,800 kg	8,000	Development
CSS-X-10 (DF-41)	DF-41	ICBM	Single warhead or 6 to 10 MIRV, 2,500kg	12,000-14,000	Development
DF-25		MRBM	Single warhead, 1,000 or 2,000 kg	1,700	Development
DF-A		SRBM	Same as DF-11	280	Operational
Guided WM-80	Guardian 2	BSRBM	Single warhead,	80	Operational

Table 2. PRC ballistic missile inventory from www.missilethreat.com/missiles

China has been modernizing its strategic missile forces since the mid-1980s by shifting from liquid fueled missiles in silos to solid fueled mobile systems. Additionally, according to LTG Hughes, Director of the Defense Intelligence Agency in 1999, "China's strategic nuclear force is small and dated, and because of this, Beijing's top military priority is to strengthen and modernize its strategic nuclear deterrent. Numerous new missile systems are under

development, along with upgrade programs for existing missiles, and for associated command, control, communications and other related strategic force capabilities. While the pace and extent of China's strategic modernization clearly indicates deterrent rather than 'first strike' intentions, the number of Chinese strategic missiles capable of hitting the United States will increase significantly during the next two decades (Hughes, 1999)." China has also reportedly acquired the Russian S-300 system (SA-10) that has capabilities similar to the Patriot PAC-2 plus (Monterey, 2003). Although aggressively modernizing, there are occasional setbacks. In the summer of 2004, a test of the developmental SLBM, the JL-2, went awry setting that program back an undetermined amount of time (Gertz, 2004).

According to the 1999 and 2001 NIEs, China will likely have tens of missiles aimed at the United States after adding more survivable, mobile land-based and sea-based missiles. Chinese officials have repeatedly stated that they will tie the speed and size of their nuclear modernization efforts to what the United States does with their missile defense (Eckholm, 2000). China has also poured a significant amount of money into ballistic missile countermeasure research (decoys, chaff, etc.). During one of China's flight tests of its latest mobile ICBMs, it included decoys (Gertz, 1999). For some time, Beijing has had the capability to deploy multiple warheads atop its current ICBM force—but it has chosen not to do so (Manning, 2000). Whether it can deploy or will deploy multiple warheads atop its DF-31 and DF-41 missiles may very well depend on how aggressively the United States continues to deploy a GMD.

In summary, China has been modernizing its strategic nuclear forces faster than anyone has anticipated, escalating the threat to Taiwan, American forces and bases in Asia, and to the balance of power in the region (Halloran, 2005). China's missile force, called the Second Artillery, had been deploying 50 to 75 short-range missiles a year; that has increased to more

than 100 and in 2006 it is predicted Second Artillery will have 800 missiles aimed at Taiwan (Halloran, 2005). This year, China's military budget has increased to 12.6 percent of its Gross Domestic Product, continuing a recent tradition of double-digit military spending. To put the 12.6 percent into context, China's military budget is estimated at $80 billion putting it in third place behind the United States in Russia (Halloran, 2005). It must be noted that due to the use of state run companies and the closed society of China, true budget figures are hard to come by. In fact, the United States Arms Control and Disarmament Agency estimates that Chinese military expenditures are probably 7-8 times higher than official budget figures provided by the Chinese government (Global Security, 2005). For the foreseeable future, Chinese strategic missile capabilities will far outstrip any U.S. capability to shoot them down.

Russia

Although the Soviet Union collapsed in 1991, there was no disarmament – Russia inherited a large Soviet nuclear arsenal and has since modernized it. The 1998 Rumsfeld commission concluded that Russia remains a strategic threat due in large part to concern over its precarious transition to a stable democracy. The number of missiles in the Russian inventory is likely to decline from Cold War levels in that large numbers of strategic missiles deployed in the 1970s and 1980s are scheduled to be retired. Still, Russian ballistic missile forces continue to be modernized and improved, although the pace of modernization has been slowed from planned schedules by economic constraints. That being said, Russia has increasingly relied on nuclear deterrence as a military option which is more cost effective than maintaining a large standing force. Table 3 illustrates the still sizable Russian ballistic missile inventory.

Designation	Alternate Name	Class	Payload	Range (km)	Status
FROG-7B	R-65/70 Luna M	BSRBM	Single warhead, 200 to 457 kg	68	Operational
SS-1B ‘Scud A’	R-11	SRBM	Single warhead, 950 kg	190	Operational
SS-1C ‘Scud B’	R-17	SRBM	Single warhead, 985 kg	300	Operational
SS-1D ‘Scud C’		SRBM	Single warhead, 600 kg	550	Unknown
SS-1E ‘Scud D’		SRBM	Single warhead, 985 kg	300	Undeployed
SS-18 Mod 3	Satan, RS-20B	ICBM	10 MIRV warheads	15,000	Operational
SS-18 Mod 4	Satan, RS-20V	ICBM	10 MIRV warheads	15,000	Operational
SS-19 Mod 1	Stiletto, RS-18, UR-100	ICBM	6 MIRV warheads	9,000	Operational
SS-19 Mod 2	Stiletto, RS-18, UR-100NU	ICBM	6 MIRV warheads	10,000	Operational
SS-21 A	Scarab A, OTR-21, Tochka	BSRBM	Single warhead, 482 kg	70	Operational
SS-21 B	Scarab B, OTR-21, Tochka-U	BSRBM	Single warhead, 482 kg	120	Operational
SS-23	Spider, OTR-23, Oka	SRBM	Single warhead, 716 to 772 kg	500	Operational
SS-24	Scalpel, RS-22, RT-23U, Molodets	ICBM	10 MIRV warheads	10,000	Operational
SS-25	Sickle, RS-12M, Topol	ICBM	Single warhead, 1000 kg	10,500	Operational
SS-26	Stone, Iskander, Tender	SRBM	Single warhead, 480 to 700 kg	280	Operational
SS-27	Topol-M, RS-12M1/M2	ICBM	Single warhead	10,500	Operational
SS-N-8 Mod 1	Sawfly, RSM-40, R-29, Vysota	SLBM	Single warhead	7,800	Operational
SS-N-8 Mod 2	Sawfly, RSM-40, R-29, Vysota	SLBM	Single warhead	9,100	Operational
SS-N-18 Mod 1	Stingray, RSM-50, R-29R, Volyna	SLBM	3 MIRV warheads	6,500	Operational
SS-N-18 Mod 2	Stingray, RSM-50, Volyna	SLBM	Single warhead	8,000	Unknown
SS-N-18 Mod 3	Stingray, RSM-50, R-29R, Volyna	SLBM	7 MIRV warheads	6,500	Operational
SS-N-20	Sturgeon, RSM-52, R-39	SLBM	10 MIRV warheads	8,300	Operational
SS-N-23	Skiff, RSM-54, R-29RM, Shetal/Shtil	SLBM	4 MIRV warheads, 2,800 kg	8,300	Operational
SS-NX-30	Bulava	SLBM		10,000	Development

Table 3. Russian ballistic missile inventory from www.missilethreat.com/missiles

The Russian ballistic missile early warning system and nuclear command and control system have also been affected by aging and delays in planned modernization. In the case of a crisis growing out of civil strife, present early warning and command and control (C^2) weaknesses could pose a risk of unauthorized or inadvertent launch of missiles against the United States (GPO, 1998). Accurate intelligence on Russian command and control systems, operational practices, and launch policies would have to be in hand to properly assess the probability of an unauthorized or inadvertent launch.

Russia continues to maintain a portion of its strategic nuclear forces on high alert to achieve a rapid strike if an incoming attack were to be detected. Maintaining forces on high alert levels for rapid launch can reduce the margins for error, thus increasing the risk for error (Wright, 2000). An inadvertent or erroneous launch could involve one missile or many.

Russia's strategic command and control architecture lends itself to a large attack vice a small one. In 1995 a Ballistic Missile Defense Organization (BMDO; predecessor of the MDA) stated that an unauthorized Russian attack would likely vary in size from 60 to 200 warheads (BMDO, 1995) which would also obviously overwhelm any anticipated capability of a NMD.

As of 2005, Russia maintains 585 land-based ICBMs and 192 sea-based SLBMs with a total of 2,942 warheads (Bulletin of the Atomic Scientists, 2005). Although the Strategic Arms Reduction Talks (START II) promise to reduce Russia's and the United State's inventories to 3,000 to 3,500 warheads apiece, the treaty has not yet gone into effect. However, Russian Defense Minister Igor Sergeyev admitted in 1998 that by 2010 Russia will be unable to afford more than 1,500 strategic nuclear warheads. However much the Russian arsenal shrinks, its missiles will remain equipped with countermeasures including decoys, chaff, and maneuverable warheads (Lindsay, 2001). For the foreseeable future, Russian strategic missile capabilities will also far outstrip any U.S. capability to shoot them down.

North Korea

Of all the potential threats specified in various studies and papers, none is more exaggerated than North Korea. Even though North Korea has hundreds of Scuds and No Dong missiles and possibly continues to develop the longer-range Taepo Dong-1 and Taepo Dong-2, it has no proven capability to field an ICBM and certainly does not possess the capability to strike the U.S. Although intelligence estimates paint a picture that North Korea has the capability to field ICBMs, nothing could be farther from the truth. As can be seen in Table 4, the longest range missile that is currently deployed by North Korea is the No Dong which has an estimated range of 1,500 kilometers (932 miles) which gives it the capability to hit targets as far away as

Japan. It is believed that North Korea has only tested the No Dong missile once in May 1993 (NIC, 1999).

Designation	Alternate Name	Class	Payload	Range (km)	Status
No Dong B					
No-dong 1	Ro-dong 1	MRBM	Single warhead, 1,200 kg	1,300	Operational
No-dong 2	Ro-dong 2	MRBM	Single warhead	1,500	Unknown
Scud B variant	Hwasong 5	SRBM	Single warhead, 985 kg	300	Operational
Scud C variant	Hwasong 6	SRBM	Single warhead, 700 kg	500	Operational
Scud D variant	Hwasong 7	SRBM	Single warhead, 500 kg	700	Operational
Taep'o-dong 1	Moksong 1, Pekdosan 1	MRBM	Single warhead	2,000	Operational
Taep'o-dong 1 SLV		SLV	Single warhead	5,000	Development
Taep'o-dong 2	Moksong 2, Pekdosan 2	ICBM	Single warhead	6,000-9,000	Development

Table 4. North Korean ballistic missile inventory from www.missilethreat.com/missiles

North Korea is not easy to understand for three reasons. It is a Marxist-Leninist dictatorship that operates fundamentally differently than the United States does, its government enforces a statistical blackout, and the North Korean government makes its living through significant reliance on strategic deception on a grand scale (Eberstadt, 2002). With these difficulties in place, the Rumsfeld commission based its assessment of North Korean missile capabilities not on whether the country was *likely* to build long-range missiles, as previous estimates had, but rather on whether North Korea *could* build them (Lindsay, 2001). Based on the lack of recent ballistic missile testing and the observed failure of the Taepo Dong-1 test in 1998, it is hard to come to the same conclusion as of the writing of this paper. Additionally, the Federation of American Scientists has noted that the North Korean test facility is insufficient to support the development or testing of a reliable long range ballistic missile program when they visited the site in the 1990's (Lindsay, 2001).

In August 1998, North Korea conducted a flight test of a three-stage Taepo Dong-1 missile that overflew Japan during its flight which was ostensibly to put a satellite in orbit. The

missile appeared to have consisted of a modified No Dong missile as the first stage, a Scud variant as the second stage, and an unknown, solid-fueled rocket as the third stage. The test/launch was unsuccessful as the third stage either malfunctioned or blew up. This was the *only* time this missile was ever tested and it was horribly unsuccessful. The 2001 NIE no longer mentions the Taepo Dong-1 but rather focuses on the Taepo Dong-2, which has *never* been flight tested. In the 1999 NIE, it assessed that if the Taepo Dong-1 were used as a ballistic missile, it "could deliver a light payload to the United States, although with inaccuracies that would make hitting large urban targets improbable (NIC, 1999)." The assumption is that the missile would have a working third stage and would have a reentry vehicle capable of making an atmospheric reentry – technologies for which the North Koreans have yet to demonstrate any capability.

The Taepo Dong-2 missile is more advanced than anything North Korea has built or tested. It has a diameter almost twice as much as the Taepo Dong-1, is three times as large, uses a cluster of four engines in its first-stage booster, and would generate greater thrust. Therefore, the stress experienced by the missile would be greater which would probably require North Korea to build the missile out of lighter and stronger alloys rather than steel (Wright, 2003). Unless the North Koreans build the Taepo Dong-2 out of advanced alloys (for which they have little or no capability), it is unlikely that with a 500 kilogram payload it would be able to reach the western part of Alaska let alone the Hawaiian islands (Wright, 2003). Due to unconfirmed reports of construction, a primitive and heavy nuclear warhead if they even have one, no proven ability to construct a reentry vehicle, and the lack of any flight tests for the last seven years, it is unlikely that North Korea would be able to fulfill the predictions of the 2001 NIE. The far greater danger from North Korea is not whether they will develop and fire a ballistic missile at

the United States, but whether they will sell weapons grade plutonium to the person or persons willing to buy it and would then smuggle it into the United States.

Iran

Iran’s reason for fielding a credible ballistic missile force is its goal of regional hegemony and the ability to threaten U.S. forces in theater. Iran's chemical weapons and ballistic missiles, and possibly its nuclear weapon program and biological warfare capabilities, are meant to deter opponents and to gain influence in the Persian Gulf and Caspian Sea regions. The acquisition of various weapon systems may also be a response to Iran's own experience as a victim of chemical and missile attacks during the Iran-Iraq War.

Iran has one of the largest ballistic missile inventories in the Middle East (see Table 5). Most of the missiles in its inventory have been purchased from North Korea in the form of Scud-Bs, Scud-Cs and No-Dongs. Most advancements in Iranian missile capabilities have been driven by external assistance from North Korea, Russia, and China (Cirincione, 2004). The Shahab-3 missile is basically an indigenously produced version of the North Korean No Dong. Although Iran's economy is not flourishing, unemployment is high and there are frequent incidences of internal unrest due to the restrictive nature of the Islamic government, ballistic missile and weapons of mass destruction (WMD) development continue to receive very high commitments of financial and material resources. Iran is likely receiving or has received a large degree of technical assistance from North Korea and China (NIC, 2001).

The Shahab-3 missile has been tested several times. The missile blew up in two out of three tests in 1998 and 2000 and failed again in July 2002. It was successful in May 2002 and July 2003 and was last tested on August 11, 2004. In his 2004 Worldwide Threat Assessment,

Director of Central Intelligence (DCI) George Tenet assessed that Iran would not be able to begin flight-testing longer range missiles until the "mid- to latter-part of the decade" (Cirincione, 2005). In short, Iran relies heavily on imports for its ballistic missile technology and has not yet fielded a long-range ballistic missile even after a quarter century since its first purchase. Money would be better spent on efforts to dissuade other countries from providing missiles and technology to Iran.

Designation	Alternate Name	Class	Payload	Range (km)	Status
Fateh A-110	Mershad; Zelzal-2 variant	SRBM	Single warhead, 600 kg	210	Operational
M-9 variant	DF-15/CSS-6	SRBM	Single warhead, 320 kg	800	Operational
M-11 variant	DF-11/CSS-7, Tondar 68	SRBM	Single warhead	400	Operational
Scud B variant		SRBM	Single warhead	300	Operational
Scud C variant		SRBM	Single warhead, 500 kg	550	Operational
Shahab 3	Shihab 3, Shehob 3	MRBM	Single warhead, 1200 kg	1,300	Operational
Shahab 4		MRBM	Single warhead	2,000-3,000	Development

Table 5. Iranian ballistic missile inventory from www.missilethreat.com/missiles

A Disconnected National Security Strategy: A Chinese Case Study

The United States is China's biggest trading partner. In 2004 the U.S. imported 197 billion dollars of goods and exported 35 billion dollars of goods and services with China (Census, 2005). Even with such an enormous trade relation, there exist tensions between the two countries mostly as a result of U.S. resolve to defend Taiwan. Additionally, China has publicly and often stated their dissatisfaction with a fielded GMD. Playing to the whim of any country that is dissatisfied with U.S. policy is probably counterproductive, but it is apparent that more can be done in the diplomatic realm to assure China that GMD is purely a defensive measure. Many countries have stated their disagreement over the U.S. fielding of GMD, but China is a good case study to justify that while GMD continues to be tested, more should be done to assure enemies and allies of the defensive nature of GMD.

The 2002 National Security Strategy (NSS) states that "defending our nation against its enemies is the first and fundamental commitment of the Federal Government (GPO, 2002)." In National Security Presidential Directive 23 (NSPD-23), President Bush states that "defending the American people against ballistic missile threats is my highest priority as Commander in Chief, and the highest priority of my Administration (GPO, 2002)." However, the NSS also states that the United States will develop agendas for cooperative action with other main centers of global power and that the United States relationship with China is an important part of our strategy to promote a stable, peaceful, and prosperous Asia-Pacific region (GPO, 2002). The two aforementioned goals within the NSS are at odds with each other and much must be negotiated in the diplomatic arena to prevent a new arms race in Asia.

There are three main reasons President Bush has given for a National Missile Defense (NMD): more countries have developed ballistic missile technology, in the past twenty years,

there has been sufficient technological progress to make missile defense possible, and the disintegration of the Soviet Union rendered the Anti-Ballistic Missile (ABM) Treaty irrelevant. There are several popular counters to Bush's three reasons for establishing a GMD. Although thirty-six countries are on record as having ballistic missile capability, there are only four that could hit the United States: Russia, China, France, and Britain (Nessen, 2001). Although North Korea conducted a test of its Taepo Dong missile in 1998, they did not demonstrate a working inter-continental ballistic missile let alone demonstrate that they could weaponize such a missile. While advancements have been made in GMD technology, the prototype system is nowhere near 100 percent effective and significant technological challenges remain. Lastly, while the ABM treaty may, in fact, be irrelevant, what missile defense can do *to* you is as important as what it can do *for* you. Specifically, while China may be less powerful militarily than the United States and not have the same financial or technological resources, they are not powerless in their ability to respond if they believe their interests have not been taken into account.

China is the United States' fourth largest trading partner with almost $200 billion in annual two-way trade (GPO, 2002), so our economic relationship with them is by no means trivial. The Chinese have repeatedly voiced their disagreement with the Bush Administration's plans to field a GMD and argue that the end result of a fielded GMD will be to create a new arms race in Asia, the exact opposite of the advertised result. China is concerned that GMD will destabilize the world order and harm international relations and that GMD's advertised technical capability will undermine China's strategic deterrence. In fact, China's last President, Jiang Zemin, stated that research, development, deployment, and proliferation of sophisticated anti-missile systems is dangerous and that "global strategic equilibrium hinges" on adherence to the ABM treaty (Shen, 2001). Later, during a summit meeting in July 2000, President Putin and

President Jiang Zemin issued a joint statement denouncing U.S. plans on missile defense, and vowed to strengthen their strategic partnership (Eisendrath et al, 2001). Even with these warnings, in May 2001 President Bush stated his intentions to proceed with the GMD system.

China believes that it is unrealistic that the U.S. would spend 60-100 billion dollars on a system that has only “rogue states in mind” (Shen, 2001). The Chinese nuclear weapons program has been very moderate and they are suspected of having between 20-30 inter-continental ballistic missiles (ICBM). As a result of U.S. pursuit of a GMD, China has begun to debate the wisdom of its policy of no-first-use of nuclear weapons, and may reverse its previous decision not to develop multiple warhead missiles. The aim of recent nuclear tests was reportedly to develop missiles that could carry multiple warheads, but which would not be independently targetable (Eisendrath et al, 2001). One has only to read current news articles about deploying the first GMD interceptors, stationing AEGIS ships off North Korea, increased missile defense cooperation with Japan, and arms sales to Taiwan to understand why China has become apprehensive regarding U.S. policy in Asia.

China and the U.S. are interdependent in their relations. As defined, interdependence in world politics refers to situations characterized by reciprocal effects among countries or among actors in different countries (Koehane, 2001). In other words, where there is interdependence, there is sensitivity and vulnerability (Koehane, 2001). According to Robert Koehane and Joseph Nye, “realists assume the high politics of military security dominate the low politics of economics and social affairs.” The Bush administration seems to take this realist view to heart in the execution of the NSS. However, in the face of superior U.S. military power, it is not hard to imagine that China would likely be forced to use her economic power to positively affect

political results. Additionally, there are many options available to China that are considerably cheaper than developing a competing missile defense system.

NSPD-23 states that “missile defenses will also help to assure allies and friends and to dissuade countries from pursuing ballistic missiles by undermining their military utility (GPO, 2002).” However, the erection of a GMD system is having the exact opposite effect and is undermining several key goals of the National Security Strategy namely, working with others to defuse regional conflicts and developing agendas for cooperative action with the other main centers of global power (GPO, 2002). China’s concern over the U.S. national missile defense in violation of the now abandoned Anti-Ballistic Missile (ABM) Treaty has been expressed through various channels many times. Primarily, China is concerned about two issues. One is that GMD will destabilize the world order and harm international relations (Shen, 2001). The other is that GMD’s advertised technical capability will undermine China’s strategic deterrence, weakening China’s confidence in its strategic retaliatory capability (Shen, 2001). As has been observed throughout the issue of Taiwan’s independence, China is not the type of country that will meekly allow its regional hegemony to be influenced by the U.S.

China has several options available to cheaply (relative to constructing their own NMD) counter a U.S. fielded GMD. The cheapest and simplest option is that China could put its missiles on higher states of alert, thereby increasing the prospects of accidental launch (Nessen, 2001). China could also multiply the numbers of their warheads. It would not be hard for China to modestly increase the number of ICBM’s to maintain a deterrent capability against the U.S. given the limitations of GMD. Mounting decoys or chaff on missiles or delivering multiple re-entry vehicles on missiles are also effective counters to a GMD system. The Chinese argue that why would America be spending so much on a system to counter a rogue ICBM when it would

be easier and much more untraceable for a rogue state to deliver a nuclear weapon “by hand” especially when one considers that American ports handle more than thirteen million containers a year (Nessen, 2001). If a state is able to independently develop a strategic missile capability, it should also be able to develop a capability to cost-effectively defeat a missile defense (Shen, 2001).

Another perspective is that China will likely perceive an effective missile defense system as negating the deterrent effects of their nuclear capability giving the U.S. a perceived “carte blanche” to militarily intervene whenever and wherever we choose (Sagan, 2003). Most countries will not cease their protests, least of all China. China will arm itself proportionally to the U.S. missile defense capability. India and Pakistan, due to their proximity to China, will follow suit. This will cause an arms race on Russia’s borders also, possibly eliciting a similar response from them (Sagan, 2003).

Technical Hurdles

Instead of the traditional defense acquisition, testing and fielding process, the Missile Defense Agency (MDA) has been authorized to use a “fast track” method for fielding GMD components. Commonly called “spiral development”, this acquisition process allows the Department of Defense to field a system in stages more quickly without waiting for all the testing or components to be complete. The disadvantage is that the final architecture of a system may not be known at the outset because new components are intended to be added over time and individual systems are fielded before they are fully tested (Hitchens, 2003). The Bush administration plans to deploy GMD in two year blocks. Block 2004, covers the years 2004 and 2005 and is the only block for which detailed information on planned deployments is available. Block 2006 will be focused on improving and enhancing the Block 2004 GMD capability (MDA, 2005). Block 2006 progress is projected to improve existing capabilities, field additional interceptors, and conduct tests to demonstrate performance against more complex missile threats and environments. It also expects to upgrade the early-warning radar located at Thule Airbase, Greenland, for expanded sensor coverage (GAO, 2004). The initial deployment has already begun with a planned ten interceptors at Fort Greely, Alaska and Vandenberg Air Force Base in California.

Although the system has not been operationally tested, in the last seven years the MDA has conducted ten flight tests involving prototype system components. Eight of these were intercept tests, five of which resulted in intercepts (Gronlund, 2004). The last test in December 2002 was unsuccessful when the kill vehicle failed to separate from the interceptor due to a malfunction. Most recently in December 2004 and February 2005, the system failed a test when the interceptor failed to launch at all. On March 9, 2005 Lieutenant General Obering, director of

the MDA, ordered a thorough review of test procedures (Graham, 2005). He appointed a Navy Admiral to oversee future test preparations in an attempt to correct the constant technical glitches that have precluded successful tests in the last two years (Graham, 2005). The new tests are particularly important because they will be the first attempted flights of the system's interceptor missile, which is designed to fly into space and release a "kill vehicle" that would steer into enemy warheads. Previous flight tests relied on a slower, less advanced interceptor (Graham, 2005). The fact that the fielded interceptors have never been tested is rather progressive, even for the “fast track” fielding method.

A GAO report in 2003 also identified several capabilities that have not been demonstrated that are critical to enabling a hit-to-kill capability. The report stated that MDA still needs to demonstrate that:

- tracking information can be passed between sensors within a satellite;
- tracking information can be passed between satellites;
- missiles can be tracked in the midcourse phase of their flight;
- data from two satellites at different locations and angles can be successfully integrated, processed, and analyzed;
- data from the satellites can be successfully passed to other space-, air-, land-, and sea-based platforms;
- satellites can operate and make some decisions autonomously; and
- satellites can discriminate warheads from decoys. (GAO, 2003)

There have been significant investments in space-based tracking that have all failed. For twenty years the best minds have been trying to come up with a solution to enable space-based sensors to discriminate between decoys and warheads. In all cases, the programs were cancelled due to cost overruns and before any satellites were ever launched. Recently, continued cost growth on the SBIRS-High satellite program triggered a formal notification to Congress and an internal review that could lead to a scaled-back program (Singer, 2005). A congressionally mandated recertification of SBIRS-High also may be required, and program termination, though unlikely,

is a possible outcome (Singer, 2005). In fact, Thomas Christie, Director, Operational Test and Evaluation summed up the overall technical difficulties a year ago. Those difficulties are summarized in Table 6.

Limitation	Comments	MDA Mitigation Plan
Lack of a deployable boost vehicle	The Orbital booster has been tested in developmental flight tests without attempted intercepts. The Lockheed booster testing has slipped such that it may not be available for operations.	MDA is proceeding with deployment plans emphasizing the Orbital booster. Testing will continue with both designs as Lockheed booster production resumes.
Lack of a realistically placed midcourse sensor	The GMD test radar is collocated at the interceptor launch site. The FPQ-14 radar, a non-deployable asset that tracks a transmitter attached to the test target, currently accomplishes the midcourse tracking and discrimination functions.	GMD is developing a mobile, sea-based radar. The scheduled employment of this radar in the GMD Test Bed occurs in the post-2005 time frame.
Fixed intercept point	All of the flight tests to date have had similar flyout and engagement parameters. This limitation includes range constraints and a requirement not to create space debris.	The 2004 Test Bed expands the flyout range and engagement conditions. Space debris creation remains a problem. A transitioning between testing and operations is a concern.

Table 6. Major GMD Test Limitations and MDA Mitigation Plans (DOD, 2004).

All the flight tests have been research and development tests, which provide information for design modifications but do not assess the system’s effectiveness under realistic operational conditions. New tests are particularly important because they will be the first attempted flights of the system's interceptor missile, which is designed to fly into space and release a "kill vehicle" that would steer into enemy warheads (Graham, 2005). Resources should be focused not on

fielding a system that is not ready, but rather should be spent on much needed testing that more reflects a true operational environment.

Perhaps the progress in fielding GMD can best be summed up by a January 17th press conference by Pentagon spokesperson Larry Di Rita. He stated that the Ground-based Midcourse Missile Defense System being deployed in Alaska and California has, at best, a “nascent operational capability.” “Operational capability” has a very specific meaning for Pentagon weapons programs: in order to reach this level of development, they must have passed very explicit testing milestones. According to Di Rita, “We haven't made a declaration that we are now hereby operational. I don't know that such a declaration will ever be made,” and, instead, there will be a “focus on testing and evaluation of the system." This announcement came on the heels of a flight test failure in December 2004 and before a second attempt in February 2005 also failed. Di Rita explained the Pentagon’s attitude toward missile defense: “The system is what it is, and it will get better over time.”

Structured Testing

A symptom of having a system deployed before it is operational is that it will not have been properly tested in realistic conditions. In fact, the intercept tests to date have included many artificialities and limitations which have been fully acknowledged by the MDA. In every test so far, detailed information was provided in advance to missile system operators. The information included timing, trajectory, intercept location, and characteristics of the target (infrared signatures, etc.). The targets have also included GPS transponders to update their position to the launch facility. The tests have also not been varied. The test geometries, closing speed and angle have been nearly identical (Gronlund, 2004). The tests have occurred at the

same time of day, even though the infrared signal of an object in space depends strongly on whether it is in sunlight or in shadow. And in each test the target cluster included the same or similar objects (Gronlund, 2004).

The targets that have been used have either not included decoys or the decoys have had signatures quite different from the target providing a test that is easier than what would likely be seen in reality. In every test, the intercept booster was a two-stage model vice the three-stage model that is installed in the Alaskan and Californian silos. This means that the interceptor has had a top speed of 2.2 kilometers per second compared to a planned speed of 7 to 8 kilometers per second for the operational interceptor (UCS, 2005). In all the tests to date, the flyout distance between where the interceptor is launched from and where it makes its intercept has been 700 kilometers while in reality that distance would be six to eight times this distance (UCS, 2005).

Easy to Defeat

Complexities of consummating an ICBM intercept aside, there are additional complications to the fire control solution that have not even been tested against. Those complications are: decoys, chaff, terminal maneuvering, and overwhelming the system by sheer numbers. Even though a country developing an ICBM may not have the capability to develop chaff or decoys, they would likely have the ability to pay for such “extras.” It is also not without reason to assume that if a country is capable of fielding a working ICBM, then it is capable of incorporating decoys or chaff. One must consider that the business of putting decoys and chaff in ICBMs is not new – the U.S, Russia, and China have been doing it for decades. The National Air and Intelligence Center reported as recently as 1999 that China tested its road-mobile DF-31

missile which included decoys and chaff (Eisendrath et al, 2001). Russia's SS-27 Topol-M, their newest missile that is in production, not only has complicated decoys and chaff, but also is capable of conducting terminal maneuvers making it extremely difficult to hit. Technology available to anyone now has the capability to enable decoys to emit infrared, visible, and radar signals identical to the warhead.

To illustrate the effect decoys and chaff has on the success of an engagement, Eisendrath, Goodman and Marsh propose the following simple statistical example: If the rocket portion of the interceptor has a reliability of 90 percent, and the probability of finding the warhead among the decoys is 90 percent, and the chance of hitting the attacking warhead after discrimination is 90 percent, the chance of hitting the warhead with one interceptor is 73 percent. If a 98 percent chance of stopping the missile is desired, you would need three interceptors (Eisendrath et al, 2001). Note that in the previous example all the probabilities are tremendously optimistic given the test results of GMD so far. Additionally, if more than one decoy is employed which is a likely scenario, then it may take as many as *seventeen* interceptors to ensure a 98 percent probability to hit for just one missile (Eisendrath et al, 2001). The Air Force and CIA have both asserted that "Russia and China have each developed and deployed numerous countermeasures and probably will sell some related technologies (Eisendrath et al, 2001)."

Components Not Yet In Place

The two systems in GMD that aid in target discrimination operate in two frequency bands: infrared and X-band (wavelength of 3 centimeters). The SBIRS-High and STSS satellite constellations are not part of the Block 2004 deployment. In 2000, a panel of independent scientists and engineers conducted a detailed technical assessment of the missile defense system

under development by the Clinton administration. That system would ultimately have included up to nine X-band radars with very good discrimination capabilities as well as a constellation of satellite-based infrared sensors. The panel found that the fully deployed system would be rendered ineffective by unsophisticated but effective countermeasures (UCS, 2004). Currently, target discrimination is solely conducted by the kill vehicle's infrared sensor. The priority should not be on placing more "operational" interceptors in silos, but on completing operational testing and deployment of components necessary for the system to work as a whole.

A Huge Cost

Since World War II, the U.S. has expended more than $100 billion making missile defense the most expensive research project in history but has barely produced a fraction of the reliability to justify the cost or deployment (Eisendrath et al, 2001). In fact, cost has been one factor that has most impassioned the missile defense debate since its inception. DOD has budgeted approximately thirteen billion dollars between 2004 and 2009 for research, testing and fielding of missile defenses (MDA, 2005). There has already been $12.4 billion spent between 1996 and 2003 in addition to the almost $100 billion spent researching the previous incarnations (GAO, 2005). The GAO reported, and MDA concurred, that almost $13 billion will be needed between fiscal year 2004-2009 for costs associated with ground-based missile defense (GAO, 2004). One need only go to the GAO website and do some cursory searches on missile defense costs to see that funding has been a congressional hot button for over a decade – there are dozens of reports about it.

The FY06 budget requests continuing development, testing, and fielding of missile defense technologies designed to defeat ballistic missiles of any range during any phase of their flight. The budget also will continue advanced research of technologies that are the most promising for strengthening U.S. missile defenses. The FY 2006 plan will add five Ground-Based Interceptors for a total of 21 (DOD, 2005). The FY06 request is less by a billion dollars from 2005 mainly due to not funding a new high-speed missile interceptor. Of the $8 billion requested for FY06, $856 million is going to the acquisition of 108 Patriot PAC-3 missiles and Medium Extended Range Air Defense System (MEADS) research, $757 million to help put the SBIRS-high program back on track (although there is still no estimate on when the first satellite will be launched), $1 billion to prepare THAAD for intercept testing, $836 million for further

Aegis ballistic missile defense testing, and $2.3 billion for testing and building the ground-based midcourse missile defense system (Boese, 2005). When considering the increasingly expeditionary nature of U.S. armed forces deployments, one would think that the funding priority would go to deployable (THAAD and Aegis BMD) theater missile defenses that are more technologically mature, executable, and necessary.

GMD has some factors that are likely to work against further progress. Specifically, there can be three factors that affect cost growth in missile defense programs: they are highly political; they are rushed into development or operation based on a perceived, urgent near-term threat; and the technical challenges are significantly underestimated (Mosher, 2003). Mosher proposes that if a threat to the United States is great enough, a weapon system's cost becomes a secondary issue (Mosher, 2003). However, the ICBM threat to the United States may not be as urgent as has been publicized, nor may it be as soon as we think. The danger is that if the threat does not become substantiated, cost can play a central role in changing or even canceling the program (Mosher, 2003). In 1998, a blue-ribbon commission headed by retired General Larry Welch noted that the urgency in missile defense programs had lead to high levels of risk and "less-than-minimal testing or highly compressed flight testing or both" (Mosher, 2003). The panels view was that the assumptions driving the GMD program have been even more optimistic. Instead of accelerating development times, the panel found that crash programs were leading to program delays (Mosher, 2000). There are several recent examples of cancellations: the Army's Crusader and Commanche programs, the Navy's A-12 fighter, and the Air Force's B-70 bomber. It may not matter how much money is invested – the 1970's Safeguard ABM system was cancelled four months after it became operational after spending $23 billion (in year 2000 dollars) (Mosher, 2003).

The technological challenges of fielding an operational GMD have been difficult and consistently underestimated. As was seen in the Safeguard program, a missile defense system must be carefully designed to account for the inevitable problems and technical challenges it will encounter and that proposed budgets must as accurately as possible reflect the costs of meeting those challenges (Mosher, 2000). The GMD system with a modest flight test program and a system that is deployed without the sensors it needs to effectively shoot down incoming ICBMs is pushing the envelope on the spiral development philosophy. The primary motivation for adopting this approach has been cost – a single GMD flight test that pits a single interceptor against a single missile costs $80-100 million (Mosher, 2000). MDA should acknowledge the high cost of testing and conduct it in as close to an operational environment as possible before spending money on operational costs and purchasing interceptors that have not been tested.

The debate about missile defense is proof positive of how political the program has become. Despite the debate, missile defense budgets have held fairly steady the last several years and probably will do so while President Bush is in office. However, in light of increasing domestic concerns and a probable future drive to reduce budget deficits, it cannot be expected that military budgets will remain untouched. Even within the military budget, there are other priorities that will compete for dollars: transformation, homeland security, modernizing conventional forces, operations costs as a result of fighting two wars in Afghanistan and Iraq, and increasing force level requirements. Against this backdrop, missile defense programs will have to compete for resources and if programs are unsuccessful, will face increased Congressional scrutiny slowing programs and funding and risking cancellation (Mosher, 2003).

1. Funding levels for GMD may be constant, but the costs can be expected to grow as work continues on fielding the required satellites and further unanticipated difficulties

arise. If costs continue to rise above projections, Congressional resistance will increase and MDA activities will be scrutinized under a microscope. Each interceptor has a cost of 25 million dollars. If twenty missiles are fielded as planned, then 500 million dollars may be wasted on interceptors that might be proven ineffective by further testing. Before more money is spent on GMD interceptors, production on interceptors should stop and the money reprogrammed. GMD should not be cancelled, but testing must be completed before calling it operational.

Global Strategic Repercussions

The gain for what limited defense GMD can provide is far outweighed by the diplomatic and strategic consequences the United States may suffer. Many countries are on record in their staunch opposition to an American GMD. The arguments are that GMD undermines strategic stability by threatening the ability of other countries to retaliate, which is likely their only means of deterrence, that it will destabilize arms control programs, and will create a new arms race. For example, rogue states will choose to utilize more insidious and anonymous means of delivering nuclear weapons such as smuggling, rather than traceable and perceived “futile” ballistic delivery means. In fact, Russia and China have both made these exact same cases: Russia argues that GMD diverts resources from the war against terror and runs counter to the Bush-Putin commitment to reducing nuclear arsenals while China has declared that Japan's missile defense plans could undermine the regional balance and trigger a new arms race (Evans, 2004). There is also fear of a domino effect: In response to U.S. construction of a robust missile defense, Russia maintains a larger nuclear force, China follows suit by building more missiles, India responds to China and then Pakistan responds to India’s increases. Theater defenses do not pose the same dilemma, so they are usually not as controversial in an international forum (Evans, 2004). However, where and when they are fielded should be handled at the highest levels with the countries of concern in the area.

To most countries, American GMD is a prime example of hypocrisy. As long as the U.S. harbors an inventory of some 5,000 weapons (many on alert), promotes the development of new nuclear weapons, and advances the construction of a ballistic missile defense, other nations will be less inclined to cooperate to control nuclear proliferation (Shanahan, 2004). The U.S. also expects other countries to follow the Missile Technology Control Regime (MTCR) while

proposing to change it in order to allow missile defense technologies to be shared with close allies (namely Australia and Japan). The danger has been succinctly summarized by Mohamed El Baradei, head of the International Atomic Energy Agency: "If we don't stop using double standards, we shall be piled high with an even greater number of nuclear weapons." Thus, aggressively deploying GMD without laying the sufficient diplomatic groundwork will create the exact opposite of the professed objective of global missile defense: “security for all who want it” (Evans, 2004).

Russia

Russia fears that the United States is creating a first-strike capability by deploying a national missile defense. One of the first public Russian criticisms of a U.S. GMD occurred in January 1999 when the Russian foreign ministry issued a statement calling the U.S. missile defense deployment plan a “serious threat to the whole process of nuclear arms control as well as strategic stability (Eisendrath et al, 2001).”

After withdrawal from the START II Treaty, Russia has deployed multiple independently targetable reentry vehicles (MIRVs) on ICBMs. Putin announced in October 2003 that Moscow intends to place dozens of MIRVed SS-19s in the inventory and also extended the service life of its SS-18 ICBMs (one of its largest models) (Eisendrath et al, 2001). Russia began construction on the fourth-generation *Borey* class of submarines, is MIRVing its silo-based SS-27 Topol-M’s, and is finishing testing of the mobile version of the Topol-M (Evans, 2004). Russia has invested considerable funds on its new Topol-M ICBMs, originally designed as a counter to SDI. They are likely to be particularly effective against American missile defenses due to their ability to

conduct maneuvers in the terminal stage and also that they likely employ sophisticated countermeasures such as chaff and decoys.

Since 2002, Russia has invested increasingly large amounts into its missile defense systems including its Patriot PAC-2 similar S-400 system and its new S-500 TMD system and has also tested ship-based interceptors. Before the U.S. withdrawal from the ABM treaty, they were devoting scarce defense funds only to conventional air defense systems (Evans, 2004). Russia’s military exercises have become increasingly complex and are beginning to approach levels not seen since the days of the Soviet military. A May 2003 exercise even involved hypothetical nuclear strikes on the United States and the neutralization of American satellites to counter the U.S. military’s greatest strength – their C4I infrastructure (Evans, 2004).

China

Perhaps no country is as vehemently opposed to an American GMD as China. Unlike Russia who has thousands of strategic warheads, China has only twenty or so. They are much more threatened by a U.S. GMD system than by an arsenal of several thousand nuclear weapons. China’s top arms negotiator has stated specifically that China would link its attitude toward nonproliferation and modernization of its nuclear forces to developments in the U.S. National Missile Defense program (Eisendrath et al, 2001). China’s strong fear is that their deterrence is at risk from a strong U.S. missile defense.

China’s likely fear is that the U.S. could strike at China first. With their comparatively small strategic nuclear arsenal, China is probably concerned that only several of their ICBMs would survive. Since they would only have a few left, China is likely concerned that any of their

remaining missiles could be destroyed by the U.S. GMD. Since the United States does not have a "no first use" policy like the Chinese, to them a U.S. first strike may appear to be a possibility.

Chinese studies and media reports are rife with stark concern over their perception that the U.S. is trying to strengthen its role as a global hegemon. From their perspective, there is some truth to the matter. Recent events have added to Beijing's perception that some American policies and actions are evidence of an objective to contain and challenge China as a major power in Asia. Following is a list of major recent incidents that China has seen as threatening or anti-China (Finkelstein, 2001):

- The 1999 bombing of the Chinese embassy in Belgrade.
- President Bush's negative references to China during his campaign and during the first months of his administration.
- Stated American policies of pre-emption and unilateral action.
- Increased military contacts with Japan and South Korea.
- American withdrawal from the ABM treaty without consultation or negotiation with Beijing.
- Recent and close cooperation on missile defense with Japan.

Although there have been positive signs that relations could warm, the recent Chinese passage of a law that authorizes military force in the event Taiwan declares independence demonstrates that there is much diplomatic work at hand.

The main point of friction in U.S.-Sino relations is over the issue of Taiwanese independence. It is with good reason. In the last five years, beginning in the Clinton administration and continuing under President Bush, Taiwan has become the world's third-largest recipient of U.S. security assistance, behind Egypt and Israel (Halloran, 2004). China remains fearful of nuclear blackmail on the Taiwan issue, and the deployment of even a modest TMD capability in the area could encourage China to adopt a more aggressive posture. Japan and the United States already have a military alliance, and the further integration of Taiwan into

any missile defense capability could mark the beginning of an explicit U.S.-Taiwanese alliance against the mainland (Evans, 2004).

An obvious response to a deployed American (and possibly Japanese) GMD would be to increase the number of ICBMs in their arsenal. American National Security and Military Strategies are rife with references to the "strategic rival" that China is becoming, seemingly creating a self-fulfilling prophecy that a U.S.-China clash is inevitable and that in order to preserve U.S. freedom of action, the United States cannot allow any nation to get the better of its military forces with a nuclear missile. However, the Chinese believe that U.S. and Japanese missile defenses are an offensive move or as they call it, "the shield followed by the sword" (Eisendrath et al, 2001). China is doing much more than increasing the number of ICBMs in its arsenal.

While China began modernizing its forces in the 1980s, it has been influenced more recently by the public announcement of American missile defense plans. Not surprisingly, Beijing is moving toward a more diversified, invulnerable, and combat-ready operational triad of nuclear forces. China's current strategic deterrent consists of 20 silo-based Dong Feng-5 ICBMs, which are liquid-fueled and thus kept at low readiness with their warheads and fuel stored separately (Evans, 2004). China's newest intermediate-range ballistic missiles are solid-fuel mobile Dong Feng-21As, and China is developing mobile ICBMs as well. If China believes that American global missile defenses are undermining its nuclear deterrent, it could employ Multiple Independently Targetable Reentry Vehicles (MIRVs) on their missiles and attach decoys to its ballistic missiles. In a tense situation, such as exists in the Taiwan Strait, missiles on high alert only aggravate the possibility of escalation or accidental or preemptive war. China also recently purchased the Russian S-300 missile defense system and if history holds true, will reverse

engineer and possibly improve it or worse yet, sell an improved version to Iran or whoever can afford it. Additionally, China has recognized that the U.S. military's dependence on vulnerable space-based assets is a critical vulnerability and has accelerated its military space program, exploring ways to neutralize American military satellites in the event of conflict (Evans, 2004).

One of the most frightening consequences of deploying a missile defense would be an end to any influence Washington has in controlling or limiting China's technological transfers to countries such as Iran and Pakistan. China might not be so inclined to join the MTCR. A U.S. GMD will lead China to share more, and not less, nuclear and missile technology with other states (Eisendrath et al, 2001).

Our Allies

A country must not only consider the repercussions of decisions from their strategic rivals, but also how it affects their alliances. Gauging the effect of American missile defense deployment on the strength of the NATO alliance is somewhat misleading as the alliance is made up of quite a few European countries, all of which have their unique, individual views on the topic (Davis, 2004). Although many European governments acknowledge that there is a growing ballistic missile threat, they see it as one that is less immediate and acute than others, such as terrorism and instability on the eastern and southern borders of Europe (Davis, 2004).

The majority of Europe is also extremely concerned about the weaponization of space fearing that it could lead to further strategic destabilization and add another impetus to an arms race that is already in progress. Additionally, to achieve effective radar coverage without relying on space-based sensors, radars will need to be placed in other countries. Why would a country allow themselves to be associated with our missile defense system when they themselves do not

benefit from its protection? As such, the U.S. would be forced to act unilaterally against any rogue state possessing nuclear weapons. Allies, who do not possess a working GMD, would likely not risk the likelihood of a nuclear attack against them.

Most European countries do not support a National Missile Defense either for themselves or by the U.S., but do however approve of TMD. While the Bush administration is determined to push ahead with a layered system to guard against a long-range missile attack, Europe is primarily concerned with protecting forward-deployed forces and naval fleets from cruise missile and short-range ballistic missile attack (Davis, 2004). In fact, NATO has already invested millions in feasibility studies on costs and timescales for deploying a TMD system (Davis, 2004). Within NATO especially, TMD is acceptable, but NMD is not. No European nation has asked to join the system and only Australia and Japan have openly supported it (Davis, 2004).

Even Britain, one of the United States' staunchest allies, is not in full agreement about deploying GMD. In July 2001, the first detailed attempt to assess the opinions of the general British public on the UK's possible role in enabling U.S. missile defense plans was conducted by the British American Security Information Council (BASIC). Results indicated that 70 percent of people in Britain believed the U.S. plans would lead to a new arms race, and 62 percent thought that the creation of NMD would make disarmament harder to achieve (Davis, 2004). If the United States is to go ahead with GMD, little help or funding will come from outside the country, especially if the system remains unproven and the threat is not urgent.

Homeland Security Issues

The most effective way to attack the United States with a weapon of mass destruction is not by launching a ballistic missile, but by smuggling it into the country whether by air, land, or sea. These methods are better for the enemy because they are:

- Less expensive
- Can be covertly developed and deployed
- More reliable
- More accurate
- More effective for disseminating a biologic or chemical agent
- Not affected by missile defenses

It was Sun Tzu who espoused the tactic of attacking your enemy's weakness with your strength. An enemy with a weapon of mass destruction to deliver will most likely choose the easiest route: a U.S. port or one of the two borders. Recent border patrols by concerned citizens such as the "Minutemen" group have highlighted the fact that both U.S. borders remain dangerously porous.

The argument that GMD effectively defends against ICBMs from rogue states is disingenuous. Besides the fact that the threat might not be as urgent as previously discussed, ICBMs are inappropriate as terror weapons. If a country were to launch one against the United States, the obvious genesis of such a weapon would ensure that a devastating retaliation would follow. It follows that any state that develops strategic weapons is doing so to develop a tool of "geopolitic strategy, not state terrorism" (Eisendrath et al, 2001). Former Secretary of Defense Harold Brown suggests that the United States would gain more protection from rogue state threats by beefing up U.S. customs than by deploying GMD (Eisendrath et al, 2001).

If the U.S. were to cut back on the operational costs of GMD, there are other higher priorities that could receive more funding attention. Michael O'Hanlon suggests the following

several priorities that should receive increased funding over GMD operational costs (O'Hanlon, 2001):

- Increased security at U.S. borders and other points of entry
- Increased security for key physical infrastructure in the United States
- More preparations for consequence management of mass casualty attacks
- Improve human intelligence programs for countering terrorism
- Expand cooperative threat reduction efforts
- Develop and deploy national cruise missile defenses

Of the aforementioned priorities, the most urgent need is securing U.S. borders and improving port security and the reason is simple: they are the easiest way to gain access to the United States. U.S. borders and ports are exactly the type of weak points that Sun Tzu was referring to. Perfect border and port security is unattainable and even if it were possible, the impact to free trade would be large but security should be good enough to stop the smuggling of large objects into the United States.

American Association of Port Authorities (AAPA) President Kurt Nagle stated that the program's biggest problem they face is a serious lack of money to assist American seaports in paying for critical security measures (AAPA, 2005). The global economy is growing and the United States is reaping the benefits in increased trade out of and into the country. Millions of containers are handled every year at a variety of ports from virtually every country in the world. Just to keep pace with the steadily increasing flow through American ports, infrastructure improvements alone are costing several billion dollars a year. However, since 9/11, less than $125 million has been spent by the federal government on grants to improve port security throughout the Unites States in 2004 compared with $3 billion for the GMD system (AAPA, 2005). For FY05, the AAPA requested a federal funding level for America's seaport facilities of $400 million, based on Coast Guard estimates that it will cost $5.4 billion over the next 10 years

to address terrorist threats (AAPA, 2005). However, the federal funding level for FY05 was $150 million. For the last round of grants, ports received only about eight percent of what they requested (AAPA, 2005).

Another important facet of American port security is the Container Security Initiative (CSI) that was initiated in 2002. CSI is founded on four core elements (CBP, 2005):

1. Using intelligence and automated information to identify and target containers that pose a risk for terrorism.
2. Pre-screening those containers that pose a risk at the port of departure before they arrive at U.S. ports.
3. Using detection technology to quickly pre-screen containers that pose a risk.
4. Using smarter, tamper-evident containers.

The FY 2005 budget grant for container security programs was 160 million dollars which is not much considering that there are 7 million containers coming into U.S. ports each year (OMB, 2005).

In President Bush's proposed FY06 budget, the CBP portion will be $5.6 billion (USGOVINFO, 2005). Of the FY06 budget, $137 million will be for WMD Detection Technology, including $125 million for the purchase of Radiation Portal Monitors (RPM's) (USGOVINFO, 2005). The CBP already has 403 RPM's, but more are needed to be able to screen all trucks, trains, cars, containers, airfreight, and mailbags (USGOVINFO, 2005). If it is easier, cheaper, more reliable, and more probable that anyone could smuggle a WMD into the United States across a border or via a ship or airplane, then protecting U.S. borders should have priority over the less probable threat (ICBMs). Senator Joseph Biden warned of just such a threat in a speech at the National Press Club. He cited the Joint Chiefs' support of his view that a nuclear attack "is less likely than regional conflicts, or major theater wars or terrorist attacks at home and abroad. If we spend billions on missile defense, we will have diverted all that money

to address the least likely threat while the real threats come into the U.S. in the hold of a ship, or the belly of a plane, or are smuggled into a city in the middle of a night (Cirincione, 2004)." He made that speech on September 10, 2001, the day before the 9/11 terrorists attacks. It is a matter of priorities and likelihoods - money should be invested into the CBP for the equipment and personnel to protect the United States' borders and ports rather than rushing to field GMD against the less likely threat.

Theater Missile Defense And Ground-Based Midcourse Defense

U.S. forces deployed abroad and U.S. allies are increasingly threatened by enemy biological, chemical, and possibly nuclear weapons delivered by ballistic and cruise missiles. During the Gulf War, 23 U.S. troops were killed when an Iraqi Scud missile with a conventional high-explosive warhead hit a barracks in Saudi Arabia. Iraq also had biological and chemical warheads that might have inflicted far greater casualties. Approximately fifty countries have ballistic missiles and many U.S. bases overseas are within the engagement ranges of such systems. Although considerable funds have been devoted toward acquiring and developing TMD systems, much more needs to be done. The U.S. military, especially the Army, is transforming into an expeditionary force likely to be deployed increasingly around the globe within range of ballistic missile threats.

Across the globe there are more countries seeking to buy SRBMs and possibly Land Attack Cruise Missiles (LACMs). The recent confirmation of a Ukrainian sale of LACMs to Iran and China show that cruise missiles are also a threat (Holley, 2005). LACMs pose more of a threat than ICBMs because they are cheaper, can be fired discreetly, and fly under any radar employed by GMD. However, TMD systems in the U.S. inventory are already capable of shooting down cruise missiles provided they are positioned correctly.

TMD systems are also critical for defense of U.S. bases abroad. U.S. bases in Japan are *already* within range of North Korean No-Dongs and are also within range of Chinese MRBMs. U.S. forces in Afghanistan and Iraq are within range of Iranian ballistic missiles. Although deployable, a TMD system such as Patriot is bulky enough that even a single battery requires significant time and airlift to move. Enough systems should be on hand to be pre-positioned at

any major base where U.S. forces are stationed. There are several systems in operation or in development. They are:

The Patriot Missile System

Although originally designed as a long-range air defense system, the Patriot missile system has been adapted over the years to counter short through intermediate range ballistic missiles. It has been sold to Germany, Greece, Israel, Japan, Kuwait, the Netherlands, Saudi Arabia and Taiwan. Although it was deployed to Kuwait and Israel during Operation Desert Storm, the system performed abysmally. In one failed intercept, 28 soldiers were killed. Initially it was believed that overall performance was satisfactory, but studies released after Operation Desert Storm confirmed suspicions that Patriot performance was unsatisfactory. Improvements were made in the PAC-2, PAC-2 Guidance Enhanced Missile (GEM), and PAC-3. The PAC-3 upgrade is the most significant upgrade as it is a hit-to-kill missile capable of engaging ballistic missiles.

During Operation Iraqi Freedom, the Patriot missile enjoyed much greater success. Of the nine short-range ballistic missiles the system engaged, eight were confirmed as shoot downs while not enough data was available from other sensors to confirm the ninth engagement. However, the system also killed three pilots when it shot down a British Tornado and American F/A-18. A separate incident was averted when an F-16 destroyed a Patriot tracking radar after it locked on to the jet. Funding priorities have been devoted to fielding PAC-3 missiles while command and control fixes still remain to be resolved. As nine countries are currently operating the system, it is reasonable to assume that data is being gathered on Patriot by potential

adversaries to develop tactics and weapons to defeat it – new systems will be required to remain one step ahead of threat missiles.

Multiple Extended Air Defense System (MEADS)

MEADS is an international co-development program between the United States, Germany, and Italy with a cost share of 58, 25, and 17 percent, respectively (GAO, 2005). MEADS improves upon Patriot capability with new components including a new battle management, command, control, communications, computer and intelligence (BMC4I) equipment, surveillance radar, and multi-function fire control radar. MEADS is expected to offer significant improvements in tactical mobility and strategic deployability over existing Patriot units. In addition, MEADS is designed to be interoperable with other airborne and ground-based sensors and utilize a netted architecture to provide a robust, 360-degree defense against cruise missiles, unmanned-aerial-vehicles, tactical air to surface missiles, rotary-wing and fixed-wing threats, and very short and medium range theater ballistic missiles (GAO, 2005). In short, it addresses most of the shortcomings of the Patriot system. However, it is not scheduled for initial fielding until 2009 and won't be fielded in its complete configuration until 2015 (assuming there are no delays) (GAO, 2005).

Terminal High Altitude Area Defense (THAAD)

THAAD is a ground-based missile defense system designed to protect deployed military forces and civilian population centers from short- and medium-range ballistic missile attacks. THAAD engages ballistic missiles during the late midcourse and terminal phases of flight before or after the warhead reenters the atmosphere. DOD expended $7.2 billion between fiscal years

1992 and 2004, Congress appropriated $760 million for fiscal year 2005, and MDA is budgeting about $4.3 billion for THAAD development and procurement between fiscal years 2006 and 2011 (GAO, 2005). The THAAD program expects to field an initial capability consisting of 24 interceptors during the 2010 time frame (GAO, 2005).

AEGIS Ballistic Missile Defense (BMD)

Aegis Ballistic Missile Defense (Aegis BMD) is a sea-based missile defense system being developed to protect deployed U.S. forces, allies, and friends from short- and medium-range ballistic missile attacks. It will also be used as a forward-deployed Ballistic Missile Defense System (BMDS) sensor, employing its shipboard SPY-1 radar, to perform surveillance and tracking of long-range ballistic missiles in support of the GMD mission (GAO, 2005). Aegis BMD builds upon the existing capabilities of Aegis equipped Navy cruisers and destroyers. Planned hardware and software upgrades to these ships will enable them to carry out the missile defense mission in addition to their current role of protecting U.S. Navy ships from air, surface, and subsurface threats. By October 2004, the Navy had modified three Aegis destroyers to conduct Long Range Surveillance and Tracking duties (LRS&T) (GAO, 2005). Two cruisers were also modified in April 2005 (GAO, 2005). Patrols of modified Aegis destroyers have already begun in the Sea of Japan (Dunham, 2004).

The Navy is also developing the Standard Missile 3 (SM-3)—the system's interceptor missile, which is designed to destroy enemy warheads through hit-to-kill collisions above the atmosphere (GAO, 2005). The SM-3 is comprised of a kill vehicle mounted atop a three stage booster. Although cruisers can fire the new weapon, destroyers will require hardware

modifications before they are capable of firing the SM-3. Eleven SM-3s are scheduled to be delivered by December 2005 some of which will be used for testing (GAO, 2005).

TMD Summary

More money for procurement and RDT&E is necessary to speed the process of deploying next generation TMD systems such as AEGIS BMD, THAAD, and MEADS (in priority). AEGIS BMD has had five out of six successes (intercepts) during testing and is running ahead of schedule and under budget (GAO, 2005). Even with the success AEGIS BMD has enjoyed, only eleven missiles are funded for 2005 (SM-3 delivery data is not available past 2005) (GAO, 2005). Although THAAD is not as far along in the testing cycle as AEGIS BMD, it is a system designed from the ground up to counter ballistic missile threats unlike Patriot which was modified to handle ballistic threats. MEADS is a cost-effective major modification to Patriot that will be more capable and interoperable than Patriot. MEADS is cost effective as Germany and Italy are footing almost half the bill of development (25 and 17 percent respectively) (GAO, 2005). All three of these systems are designed to integrate into NMD which will enhance the system as a whole.

Conclusions

For almost fifty years the United States has been testing a national missile defense of one kind or another. None have ever met with success and all have been expensive. The technical challenge of operationalizing a working missile defense is daunting, but the fact that the United States is still doggedly pressing forward on deployment is indicative of a commitment to the defense of the American people. However, there are other, more pressing and likely challenges that threaten America today. Prioritizing the fielding of GMD ahead of defenses for more likely and less expensive threats is a mistake and is a waste of American tax dollars. Developing a working GMD is necessary, but testing is not complete and the money saved from operational costs and fielding could be used for other homeland defenses and TMD systems for deployed forces.

The basics and history of ballistic missile defense at the beginning of this thesis provided the reader with a familiarity of the issues that have always plagued the development of an effective defense. With that background, the threats were examined, technical issues were reviewed, costs were researched, strategic repercussions were explored and priorities were appraised. The following conclusions are presented:

1. The threats are either not what they seem (North Korean, Iran), or they already possess arsenals large enough to overwhelm GMD as it is envisaged (Russia, China).
2. Many technical challenges remain and the system is not fully deployed. Interceptors have been placed into silos before they have been proven in a true operational environment.

3. The cost of GMD is so high that the United States will be unable to operationalize the system before it is proven.
4. There are severe global strategic repercussions of deploying GMD. Much more diplomatic work remains to diminish resistance and garner support. Continued fielding of GMD may have the opposite effects than what is intended – a more secure world.
5. If Homeland Security is the priority, then there are more likely threats that need fiscal attention such as Border and Port security.
6. TMD is a more urgent requirement than GMD. Funding priority should be given to finish fielding effective theater defenses.

Recommendations

Each GMD interceptor missile costs approximately $25 million. The GMD system will have eighteen interceptor missiles in the Fort Greely and Vandenberg AFB silos by the end of 2005 and ten more missiles are planned for purchase in 2006 (GAO, 2005). If the fielding of further missiles is reduced to what is only required for testing and fielding of major components is slowed, money saved could be diverted to other, more urgent and necessary demands. The following are several recommendations on where to focus precious resources.

Homeland Security is in Dire Need of Funds

Homeland Security is one of America's highest priorities and greatest challenges. American ports handle millions of containers a year and the CBP is not manned nor equipped to effectively patrol the nation's borders. It is much easier and more discreet to smuggle WMD into the United States via the borders or into the ports than by ballistic missile. Money that could be saved from spending on GMD should be applied to increasing CBP funding to effectively do its job. Recommendations for areas of increased funding include:

- Increase funding for the Container Security Initiative (CSI) above the current amount of 160 million dollars. Funding should allow CBP agents to deploy to ports in countries where security may be less stringent than more developed countries.
- Purchase, staff, and maintain enough RMD's to efficiently screen cargo entering into the U.S. via and border crossings.
- Currently, only 5-6 percent of inbound containers to the U.S. are physically inspected (Orphan and Muenchau, 2005). In order to inspect a greater percentage of containers

without impeding flow, purchases of Integrated Container Inspection Systems (ICIS) should be considered.

- Provide increased funding to hire enough border patrol agents to effectively patrol both borders.

TMD Is More Important Than GMD

The most valuable resource and most effective weapon in the U.S. military are the men and women in uniform. As forces are increasingly deployed to bases in other countries, effective TMD systems should be part of the force protection packages. Increased funding of TMD could be used to accelerate fielding of AEGIS BMD, THAAD, and MEADS. These systems are all planned to integrate into NMD, so their fielding would increase the effectiveness of NMD.

Intelligence Needs More Money

Why has GMD been so aggressively pressed into service? It is because the ICBM threat has been exaggerated causing a false sense of urgency. Iran and North Korea are not as far along as has been assessed. The experience of not finding WMD in Iraq should be lesson enough that even when all of the intelligence resources at America's disposal are focused on one country, they are still not always able to gather reliable intelligence. The American intelligence community has received a lot of attention and funds since 9/11, but more needs to be invested on human intelligence gathering resources. Recommendations on areas to receive increased funding are:

- Increasing the number of personnel with linguistic skills in America's intelligence organizations.

- Increase the number of analysts with sufficient language proficiency to effectively evaluate human intelligence.

Much Diplomatic Work Remains to be Done

If progress on deploying GMD were slowed while testing continues, the time could be spent engaging other countries to garner support and reduce proliferation. There are several methods by which this could be accomplished:

- Initiate discussions on a revised version of the 1972 ABM treaty and consider institution of a "no first use" policy. Verification, transparency, and reciprocity should be a part of any treaty.
- Provide more diplomatic pressure and funding to aid Russia in increased security of their nuclear warheads and materials.
- Strengthen the Hague Code of Conduct against Ballistic Missile Proliferation (ICOC). More action is needed to turn the Code into a legally binding treaty and provide real enticements to states like North Korea and Iran to abandon missile development. (Davis, 2004)
- Utilize multilateral diplomatic options such as the UN, IAEA, and on-site inspections to aggressively monitor countries that are suspected of proliferating ballistic missile technology.

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